<u>What is Claimed is</u>:

1. An iron oxyhydroxide material capable of intercalating lithium ions composed of nanometer-sized iron oxyhydroxide particles with short-range-order structures.

2. The iron oxyhydroxide material of claim 1, wherein the lithium ion intercalating capacity is at least 0.5 moles of lithium ions per mole of iron oxyhydroxide.

3. The iron oxyhydroxide material of claim 1, wherein the lithium ion intercalating capacity is at least 1.0 moles of lithium ions per mole of iron oxyhydroxide.

4. The iron oxyhydroxide material of Claim 1, wherein the particles are less than 100 nm in size.

5. The iron oxyhydroxide material of Claim 1, wherein the particles are about 30 nm in size.

6. The iron oxyhydroxide material of Claim 1, wherein the iron oxyhydroxide has a short-range-order structure, weakly resembling the phase α-FeOOH or *goethite*.

7. The iron oxyhydroxide of claim 1, wherein the chemical composition of the compound is $Na_xFe(OOH)_y$, <u>for</u> $0 \leq x \leq 0.25$ and $0.9 \leq y \leq 1.33$.

8. The iron oxyhydroxide material of Claim 1, wherein the iron oxyhydroxide particles exhibit high porosity.

9. The iron oxyhydroxide material of Claim 8, wherein the particles exhibit a Brunauer-Emmett-Teller specific surface area of at least 200 m^2/g.

10. The iron oxyhydroxide material of Claim 1, further comprising a specific capacity of at least 80 mAh/g at a rate of 0.53mA/cm^2.

11. The iron oxyhydroxide material of Claim 1, further comprising a specific capacity of at least 215 mAh/g at a rate of 0.53mA/cm^2.

12. The iron oxyhydroxide material of Claim 1, comprising an energy storage capacity of at least 400 mWh/g at a rate of 0.53mA/cm^2.

13. The iron oxyhydroxide material of Claim 1, comprising an energy storage capacity of at least 525 mWh/g at a rate of 0.53mA/cm^2.

14. A method for preparing an iron oxyhydroxide material capable of intercalating lithium ions, comprising the steps of:

oxidizing Fe(II) via hydrolysis to yield FeOOH; and

dehydrating FeOOH at a temperature and for a time sufficient to yield at least substantially amorphous nanometer-size particles of FeOOH.

15. The method of Claim 14, wherein said oxidizing step further comprises mixing an aqueous solution of Fe (II) with a mixture containing NaOCl and NaOH at ambient temperature to yield a reaction mixture.

16. The method of Claim 15, wherein the molar ratio of Fe(II):NaOCl:NaOH ranges from 1:1.5:5 to 1:5:5.

17. The method of Claim 15, wherein the molar ratio of Fe(II):NaOCl:NaOH is about 1:2.5:5.

18. The method of Claim 15, further comprising stirring the reaction mixture for about 1.5 hours, and settling the reaction mixture for about 24 hours.

19. The method of Claim 17, further comprising dialyzing the reaction mixture for about 5 days through low-pass dialysis films in deionized water to yield a dialyzed material.

20. The method of Claim 19, further comprising centrifuging the dialyzed material, and freeze drying the centrifuged and dialyzed material to yield nanometer-sized powders.

21. The method of Claim 14, wherein Fe(II) is selected from the group consisting of $FeCl_2$, $Fe(NO_3)_2$, and $Fe(CH_3COO)_2$.

22. The method of Claim 14, wherein the dehydrating step further comprises heating FeOOH to a temperature of up to 80°C in ambient air for about 24 hours.

23. An iron oxyhydroxide material prepared by the method of claim 14.